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A REVIEW OF THE SCALE INSECT SUBTRIBE ANDASPIDINA (HEMIPTERA: COCCOIDEA: DIASPIDIDAE) AND A NEW GENUS, *NOTANDASPIS*, FOR TWO AUSTRALIAN SPECIES

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Summary

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The subtribe Andaspidina is recognised as one of three subtribes of the scale insect tribe Lepidosaphini. A review of the literature is presented and diagnostic keys are given to subtribes and to genera of the subtribe Andaspidina. *Notandaspis* gen. nov. is described for *Mytilaspis (Coccomytilus) hymenantherae* Green, a species described originally from Victoria and presently included in *Andaspis* and for a new species *Notandaspis oodnadattae* sp. nov. from South Australia. The new species is unusually large for the subtribe.

KEY WORDS: Coccoidea, Diaspididae, Andaspidina, *Notandaspis* gen. nov., *Notandaspis hymenantherae* (Green), *Notandaspis oodnadattae* sp. nov., scale insects, Australia.

Introduction

Although nearly 250 species of Australian armoured scale insects (family Diaspididae) have so far been described, most of the endemic species cannot be recognised from the original descriptions without referring to authentic specimens in collections. A few species have been redescribed as part of revisions of genera but there is a pressing need for a complete revision of all the named species. Since a catalogue of world species was published by Borchsenius (1966) it would be fairly easy to extract most of the pertinent literature on Australian species. However, the work involved in also describing the new species already in collections, and those still to be discovered, estimated at many hundreds, could take many years. Numerous exotic species have also become established in Australia, some causing damage to cultivated crops and trees and these also need revision.

In the present work two species are described in the subtribe Andaspidina. Australian species at present assigned to this group are *Andaspis hymenantherae* (Green), *A. incisor* (Green), *A. numerata* Brimblecombe and *Metandaspis recurvata* (Froggatt). *A. hymenantherae* is assigned to a new genus in which a new species with an unusually large adult female is also included.

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Materials and Methods

The species are described from slide-mounted specimens of the adult female and the illustrations show the dorsal aspect on the left and the ventral aspect on the right. Morphological terminology is the same as that used in Williams & Watson (1988) where reference may also be made to a generalised illustration of the adult female. Further specimens have been prepared on microscope slides for this study using the techniques discussed by Williams & Watson (1988).

The term megaduct was adapted by Takagi (1992) from the term megapore proposed originally by Balachowsky (1954). These ducts, when present, numbering 2-7 on each side of the pygidial margin, are enlarged and are much larger than any others on the dorsum of the pygidium. The orifice of each megaduct is longitudinally elliptical and surrounded by a heavily sclerotised rim.

Abbreviations of the depositories are as follows:
ANIC, Australian National Insect Collection, CSIRO, Canberra, Australia.
BMNH, The Natural History Museum, London, U.K.

Historical Review of *Andaspis* and related genera

In the present work two tribes, Diaspidini and Lepidosaphini are recognised in the subfamily Diaspidinae. Based on the works of Borchsenius (1966) and Balachowsky (1968) the subtribes Andaspidina, Lepidosaphina and Coccomytilina are available in the tribe Lepidosaphini and are here accepted. Genera of the subtribe Andaspidina include *Andaspis* MacGillivray, *Caia* Williams, *Parandaspis* Mamet, *Metandaspis* Williams, *Saotomaspis* Balachowsky and the new genus *Notandaspis* gen. nov. here described.

The names Lepidosaphini and Lepidosaphina are used here without inflection formed from the nominal genus *Lepidosaphes* Shimer despite the various spellings Lepidosaphedini, Lepidosaphidini, Lepidosphedina and Lepidosaphidina.

The genus *Andaspis* was named by MacGillivray (1921) with *Mytilaspis flava* var. *hawaiiensis* Maskell as type species. MacGillivray also included the Australian species *Lepidosaphes incisor* Green. Hall (1946) accepted the genus and included the African species *Lepidosaphes punicae* Laing. Rao & Ferris (1952) revised *Andaspis* and included 10 species, eight of which were from Asia. Brimblecombe (1960) described the new species *A. numerata* from Queensland. Takagi & Kawai (1966) described four new species of *Andaspis* from Japan and added further records of previously described species.

In a detailed study of adult males, Ghauri (1962) accepted the subtribe Lepidosaphidina to include *Lepidosaphes* Shimer and *Andaspis*. Lepidosaphidina was accorded equal rank to the Diaspidina of the tribe Diaspidini.

Williams (1963), in a review of *Andaspis*, accepted 22 species and provided a key. Also included in the review were the new genera *Caia*, with *C. quernea* Williams from Pakistan as type species, and *Metandaspis* with *Mytilaspis recurvata* Froggatt described from New South Wales as type species. He also included *Metandaspis javanensis* Williams from Java and stated that both new genera were related to *Andaspis*.

In a catalogue of so-called Diaspidoidea of the world, Borchsenius (1966) recognised the tribe Lepidosaphidini Shimer and the two subtribes Lepidosaphidina and Coccomytilina Borchsenius. He included *Andaspis* and *Caia* in the subtribe Lepidosaphidina and *Metandaspis* in the subtribe Coccomytilina and transferred the Australian species *Mytilaspis (Coccomytilus) hymenantherae* Green to *Andaspis*.

Mamet (1967) described the new genus *Parandaspis* with *P. vinsoni* Mamet from Mauritius as type species.

Borchsenius (1967) described the genera *Raoaspis* Borchsenius with *Andaspis mori* Ferris as type species, *Pararaoaspis* Borchsenius with *Lepidosaphes meliae* Green as type species and *Roonwalaspis* Borchsenius with type species *Roonwalaspis quercicola* Borchsenius. The new species *Raoaspis indica* Borchsenius, *R. raoi* Borchsenius and *Roonwalaspis quercicola* described in the same paper were purported to be Indian in origin but Danzig (1968) indicated that the localities on all the original labels were in China. Takagi (1970), discussing the Diaspididae of Taiwan, synonymised the names *Raoaspis*, *Pararaoaspis* and *Roonwalaspis* with *Andaspis* but suggested that the genera may be valid in some degree as species-groups. All three genera described by Borchsenius possess pygidial megaducts.

Balachowsky (1968), unaware of Mamet's *Parandaspis*, described the new genus *Parandaspis* with *P. castelbranchi* Balachowsky as type species. He also discussed the tribe Lepidosaphedini and erected a new subtribe Andaspidina to include *Andaspis*, *Caia*, *Metandaspis* and his new genus *Parandaspis*. He provided a key to the three subtribes Lepidosaphedina, Coccomytilina and Andaspidina and a key to the genera of the subtribe Andaspidina.

Balachowsky (1973), realising that the name *Parandaspis* Balachowsky was a junior homonym of *Parandaspis* Mamet, proposed the name *Saotomaspis* Balachowsky to replace *Parandaspis* Balachowsky with *S. castelbranchi* as type species.

Williams (1980) synonymised the name *A. dasi* Williams, described from India, with *A. numerata* Brimblecombe and commented on its distribution in Australia and the Pacific region and its association with the symbiotic fungus *Septobasidium* sp.

Williams & Watson (1988) discussed the Pacific species of *Andaspis* including two new species from Papua New Guinea.

Takagi (1992) commented on some unusual genera of the Lepidosaphedini as a tribe of the subfamily Diaspidinae and suggested that *Metandaspis javanensis*, based on a study of the first instar and adult female, was a 'somewhat odd form' but could belong to the tribe.

Danzig (1993) recently accepted only the tribe Lepidosaphini without subtribes.

Systematics

Superfamily Coccoidea Fallén, 1814.
Family Diaspididae Targioni Tozzetti, 1868.
Subfamily Diaspidinae Targioni Tozzetti, 1868.
Tribe Lepidosaphini Shimer, 1868.

Most genera of the family Diaspididae or armoured scales are included in the two subfamilies Aspidiotinae and Diaspidinae. The subfamily Aspidiotinae, based on characters of the adult female, contains genera with peetinae or plates and lobes that are never bilobed. In the subfamily Diaspidinae the plates are replaced by gland spines and the lobes anterior to the median lobes are often bilobed. The Diaspidinae are usually subdivided into the tribes Diaspidini and Lepidosaphini. Major characters of the Lepidosaphini, mostly defined by Takagi (1969) and never found in the Diaspidini, include megaducts, a pair of gland spines between the median lobes and abdominal segments II-IV with either lateral tubercles or spurs. One or more of these characters may be absent.

In the present work the subtribe Andaspidina is recognised and can be separated from the two other subtribes of the tribe Lepidosaphini by the following key adapted from Balachowsky (1968).

Some genera and species assigned to the tribe Lepidosaphini are difficult to place in any of the subtribes. *Mercetaspis calligoni* Borchsenius, for instance, lacks lobes and gland spines but possesses megaducts. The species is nevertheless related to other species of *Mercetaspis* Gómez-Menor possessing gland spines and well-developed or reduced lobes (Danzig 1993). *Phaulomytilus* Leonardi, an Australian genus, has small conical lobes, lacks gland spines but possesses megaducts. It was included in the subtribe Lepidosaphina by Borchsenius (1966). Another Australian genus, *Allantomytilus* Leonardi, has small triangular lobes but lacks megaducts. Borchsenius (1966) included this genus in the subtribe Coccomytilina. According to Takagi (1992), *Minaspis* MacGillivray, with more or less triangular lobes, is a primitive genus of the tribe Lepidosaphini, probably of the subtribe Coccomytilina. *Howardia* Berlese & Leonardi also belongs to the tribe Lepidosaphini but its position remains obscure. The genus possesses median lobes similar to those of *Andaspis*. Each median lobe of *Howardia* has a narrow, transverse paraphysis at each basal corner and, in addition, a large club-shaped sclerosis arising from the inner basal corner. Although Takagi (1992) tentatively included *Howardia* in the subtribe Coccomytilina, the name Howardiina Borchsenius is available for it but this subtribe was erected originally to include other genera also, presently in the tribe Diaspidini. In the following key to subtribes, only those genera possessing well-developed median lobes in the adult female are included, omitting the genus *Howardia* for the present. The correct assignment of many genera must await more detailed research possibly of first and second instar nymphs.

Key to subtribes of the tribe Lepidosaphini with well-developed median lobes (adult females)

1. Median lobes with parallel or subparallel sides, each lobe either without notches or with a single outer notch. Dorsal marginal megaducts on the pygidium present or absent 2

   Median lobes not with parallel sides; each lobe with inner margin straight, diverging slightly, curving round to a long oblique outer margin, the margin either smooth or serrated. Dorsal marginal megaducts on the pygidium either present or absent ..... Andaspidina Balachowsky

2. Dorsal marginal megaducts always present on the pygidium, numbering 2–7 on each side ..... Lepidosaphina Shiiner

   Dorsal marginal megaducts always absent from pygidium ..... Coccomytilina Borchsenius

Genus ***Notandaspis*** gen. nov.

Type species: *Mytilaspis (Coccomytilus) hymenanthe rae* Green

Diagnosis

Adult female on microscope slide elongate oval, segmentation of thorax and prepygidial segments distinct. Spiracles with quinquelocular pores. Antennae each usually with 3 long setae. Pygidium rounded with median lobes prominent, set close together, triangular or oval, inner edges short and diverging, outer edges long. Second, third and fourth lobes small, represented by sclerotised points. Megaducts absent. Macroducts of pygidium, including marginal ducts, all about same size. Gland spines short between median lobes; anteriorly about same length as median lobes. Venter with microducts and gland tubercles present as far forward as head.

Discussion

This genus is erected for the type species described from Victoria and a new species from South Australia. In lacking megaducts and possessing dorsal pygidial macroducts all about the same size, the new genus is related to *Saotomaspis*, an anomalous genus without gland spines in the adult female but with all the other characters of the subtribe Andaspidina.

Etymology

The name *Notandaspis* is based on the Greek word *notos*, meaning south, combined with the present generic name *Andaspis*.

The new genus *Notandaspis* can be separated from other genera of the subtribe by the following key.

Key to genera of the subtribe Andaspidina (adult females)

1. Pygidium always with 4–7 dorsal marginal megaducts on each side, these much larger than other dorsal ducts 2

   Pygidium always without dorsal marginal megaducts, any marginal ducts present always about same size as other dorsal ducts 4

2. Median lobes each with single notch on outer margin. Anal opening situated towards apex of pygidium ..... *Cuia* Williams

   Median lobes each with outer margin smooth or finely serrated. Anal opening situated towards base of pygidium 3

3. Gland tubercles present on ventral surface of head ..... *Parandaspis* Mamet

   Gland tubercles absent from ventral surface of head ..... *Andaspis* MacGillivray

4. Dorsal ducts of pygidium, including any marginal pygidial ducts, always in the form of microducts only ..... *Metandaspis* Williams

   Dorsal ducts of pygidium not in the form of microducts, always in the form of macroducts and all about same size 5

5. Gland spines absent from pygidial margins . . . . . *Saotomispis* Balachowsky
Gland spines present on pygidial margins . . . . . *Notandaspis* Williams & Brookes gen. nov.

Notandaspis hymenantherae (Green) comb. nov.
(FIG. 1)

Mytilaspis (Coccomytilus) hymenantherae Green 1905: 5. Lectotype ♀, Victoria, Myrniong, on stems and twigs of *Hymenanthera banksii* (BMNH) (here designated) [examined].
Lepidosaphes hymenantherae (Green), Sanders 1906: 17.
Coccomytilus hymenantherae (Green), MacGillivray 1921: 293.
Andaspis hymenantherae (Green), Borchsenius 1966: 71.

Adult female

Scale described originally as 'reddish-brown, more or less covered by fibres of the bark upon which it rests'.

Adult female on microscope slide elongate-oval, about 1.8 mm long and 1.1 mm wide, widest at about first abdominal segment; body membranous to lightly sclerotised, pygidium moderately sclerotised. Abdominal segments strongly lobed laterally. Lateral spurs absent. Anterior spiracles each with a group of 4-7 quinquelocular pores; posterior spiracles each with 2 or 3 quinquelocular pores. Antennae each with 3 setae all about same length.

Pygidium rounded. Median lobes prominent, set close together, almost triangular, each with rounded apex, outer edge finely serrated and longer than inner edge; a short, blunt paraphysis arising from inner and outer basal angles. Second, third and fourth lobes represented by short, sclerotised projections. Gland spines minute and barely perceptible between median lobes; a short pair present between each median and second lobe and groups of three gland spines about as long as median lobes present between each second and third lobe and each third and fourth lobe. Anal opening situated towards base of pygidium. Vulva present near middle of pygidium. Perivulvar pores absent. Dorsal ducts of pygidium all about same size, each about 20 μm long, arranged in loose marginal to submedian groups on each segment. Other dorsal ducts on abdomen about same size as pygidial ducts, present around margins and in submedial groups of 6-10 on segment V, submedial groups of 4-9 on segment IV and usually submedial groups of 1-3 ducts on segment III. Ducts around margins becoming progressively smaller to mesothorax.

Ventral surface with marginal gland spines as far forward as abdominal segment III. Gland tubercles present on thorax and first abdominal segment. Submarginal microducts present on prothorax mesothorax and lateral lobes of abdominal segments. Small ducts situated on margins of thorax and first abdominal segment.

Diagnosis

The presence of almost triangular median lobes on the pygidium is a good distinguishing character of this species. Each outer edge of a median lobe is, nevertheless, longer than the inner edge.

The lectotype designated is one of six specimens on a single slide labelled 'Mytilaspis hymenantherae Green, Type, from *Hymenanthera dentata*. Victoria, Australia, coll. J. Lidgett No. 63' and is clearly marked in red ink. It is further located on a diagram showing the positions of all six specimens on a separate label fixed to the back of the slide. The other five specimens are here designated paralectotypes (BMNH).

Notandaspis oodnadattae sp. nov.
(FIG. 2)

Material examined

Holotype: ♀, ANIC, South Australia, 70 km west of Oodnadatta, on stems of *Acacia aneura*, 1.x.1976, F. D. Morgan.

Paratypes: same data as holotype, 8 ♀♀ (ANIC), 5 ♀♀ (BMNH).

Adult female

Scale dull white, 4 mm long, exuviae apical, pale white, cork layer of plant in some instances growing in strands over scale cover.

Adult female on microscope slide, elongate oval, largest available specimen 3.2 mm long, 1.2 mm wide, widest at metathorax, moderately sclerotised throughout, pale brown, pygidium light brown, segments well constricted behind head and prothorax and between thoracic and prepygidial segments. Anterior spiracles each with a group of 4-6 quinquelocular pores, posterior spiracles each with 1 or 2 quinquelocular pores, occasionally absent. Antennae each with 3 setae, one thicker and longer than others.

Pygidium rounded. Median lobes prominent, each almost oval, the short inner edge and long outer edge finely serrated. A pair of slender paraphyses present, each arising from inner and outer basal angles, directed antero-medially or almost transversely but not meeting. Second, third and fourth lobes represented by small sclerotised points. Gland spines short and minute between median lobes, a subequal pair present between each median and second lobe, a group of three, all about as long as median lobes, situated between each second and third lobe. Anal opening lying near middle of pygidium. Vulva situated anterior to position of anal opening, at about one third length of pygidium from base. Perivulvar pores absent. Dorsal ducts of pygidium

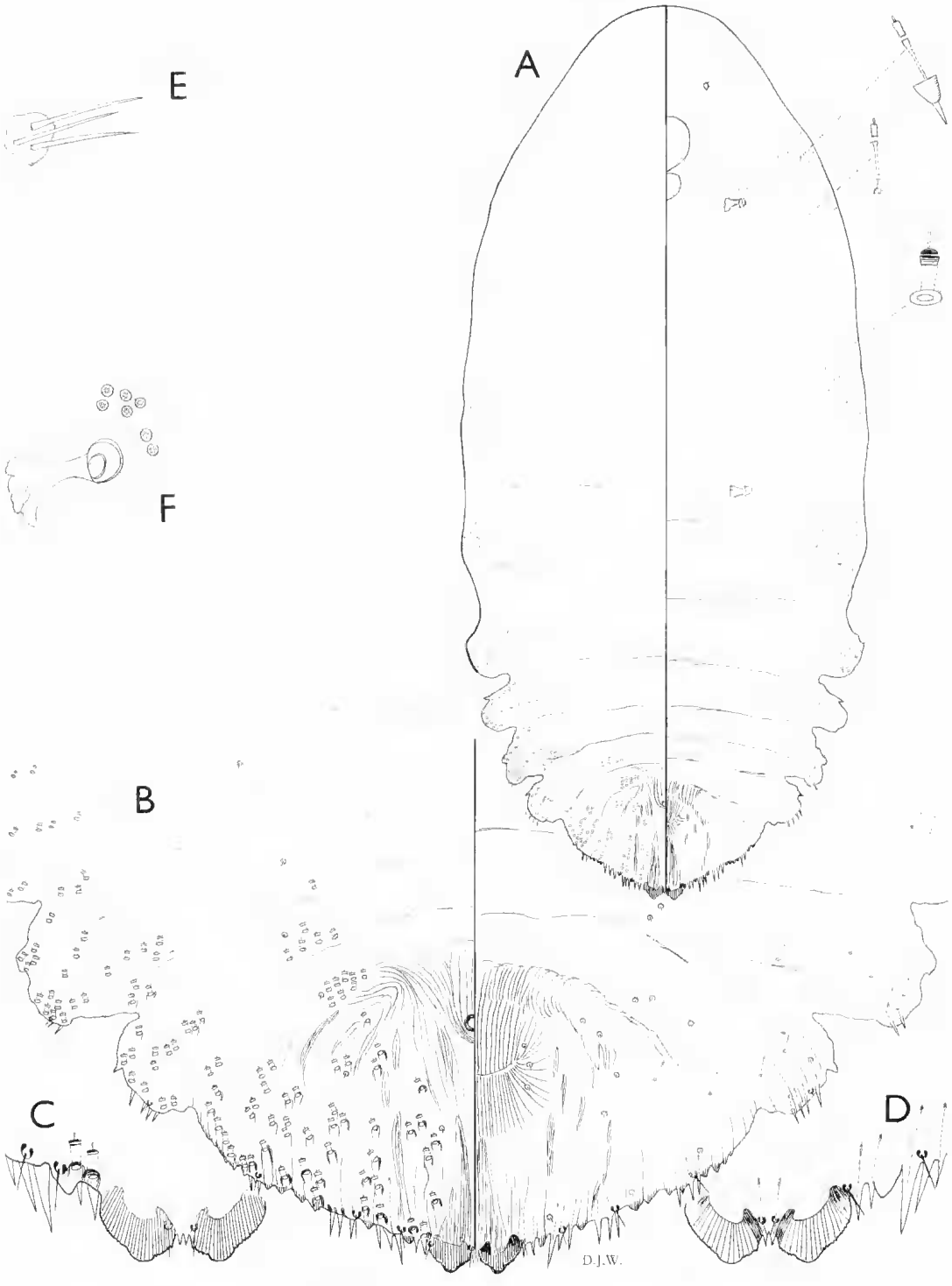

Fig. 1. *Notandaspis hymenantherae* (Green) comb. nov. A. Adult female, general aspect. B. Pygidium. C. Dorsal margin of pygidium. D. Ventral margin of pygidium. E. Antenna. F. Anterior spiracle.

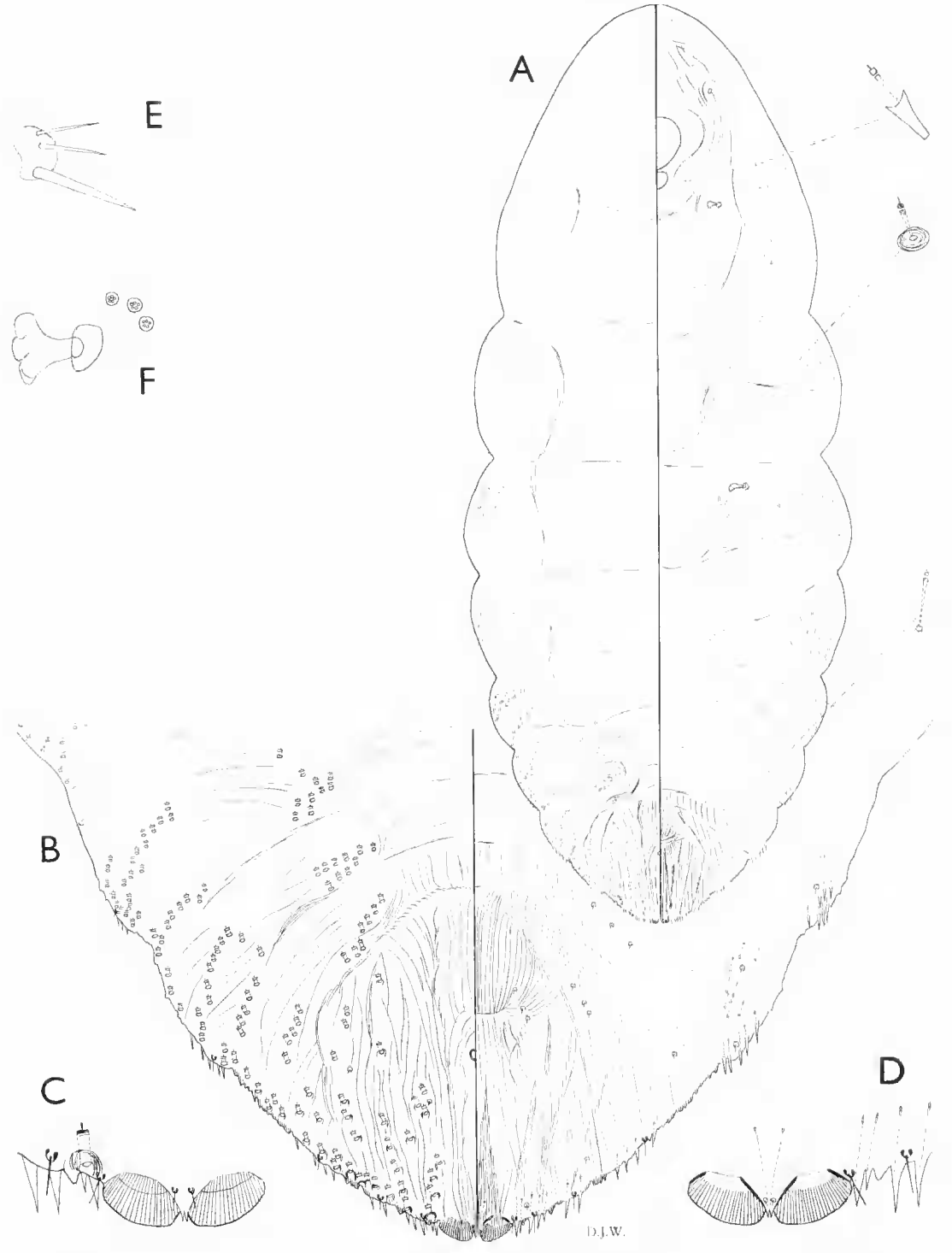

Fig. 2. *Notandaspis oodnadattae* sp. nov. A. Adult female, general aspect. B. Pygidium. C. Dorsal margin of pygidium. D. Ventral margin of pygidium. E. Antenna. F. Anterior spiracle.

all about same size, each approximately 20 μm long, numerous along margins and arranged in ill-defined rows to middle of pygidium except on segments III-V where they form distinct submarginal rows and submedian groups of 7-10. Ducts around margins becoming progressively smaller anteriorly as far forward as mesothorax.

Ventral surface with submarginal microducts of two types. An elongate type, each about 15 μm long, present in submarginal groups on abdominal segments IV and V. A shorter type, each about 10 μm long and with area surrounding opening sclerotised; present in marginal groups on head, thoracic segments and second abdominal segment, and others present in small groups near labium and medial area of head. Gland spines present in groups on prepygidial margins and minute, truncate gland tubercles present submarginally on prothorax and near inner edges of groups of microducts.

Diagnosis

This is a large species compared with others in the subtribe Andaspidina with the scale cover reaching 4 mm long and the adult female 3 mm long. The scale cover of most other species scarcely exceeds 2 mm long and the adult female is rarely more than 1 mm long. At first sight the scale of *N. oodnadattae* resembles an ovisac of many species of *Eriococcus* (Eriococcidae). Although each of the median lobes is almost oval there is a distinct, short inner edge and a long outer edge as in all species of the subtribe. The shape of the median lobes distinguishes the species from *N. hymenantherae* which possesses almost triangular median lobes. The positions of the anal opening and vulva are reversed in both species, the anal opening of *N. oodnadattae* lying posterior to the position of the vulva and in *N. hymenantherae* the anal opening lying anterior to the position of the vulva.

Etymology

The name is based on the place name 'Oodnadatta'.

References

BALACHOWSKY, A. S. (1954) "Les cochenilles paléarctiques de la tribu des Diaspidini" (Institut Pasteur, Paris).

_____ (1968) Sur une nouvelle sous-tribu de Lepidosaphedini (Coccoidea-Diaspididae) créée par la découverte d'un nouveau genre nuisible au Caféier d'Arabie à Sao-Tomé. *Rev. Zool. Bot. Afr.* **78**, 54-63.

_____ (1973) Nouveau nom de genre pour un Diaspididae de Sao-Tomé. *Bull. Soc. ent. Fr.* **78**, 225.

BORCHSENIUS, N. S. (1966) "A catalogue of the armoured scale insects (Diaspidoidea) of the world". (Nauka, Moscow, Leningrad).

_____ (1967) Materials on the fauna of scale insects (Homoptera, Coccoidea) from India. II. *Andaspis* MacG. with three new allied genera (Diaspididae). *Ent. Obozr.* **46**, 724-734.

BRIMBLECOMBE, A. R. (1960) Studies of the Coccoidea 10. New species of Diaspididae. *Qd. J. agric. Sci.* **16**, 381-407.

DANZIG, E. M. (1968) On the types of species described by N. S. Borchsenius in the article 'Materials on the fauna of scale insects (Homoptera, Coccoidea) from India, II'. *Ent. Obozr.* **46**, 843.

_____ (1993) Fauna of Russia and neighbouring countries. Rhynchota Volume X. Scale Insects (Coccinea) Families Phoenicococcidae and Diaspididae. *Fauna Russia* (NS) **144**, 452 pp.

GHAURI, M. S. K. (1962) "The morphology and taxonomy of male scale insects (Homoptera: Coccoidea)" (British Museum [Natural History], London).

GREEN, E. E. (1905) Some new Victorian Coccidae. *Victorian Nat.* **22**, 3-8.

HALL, W. J. (1946) On the Ethiopian Diaspidini. *Trans. R. ent. Soc. Lond.* **97**, 497-592.

MACGILLIVRAY, A. D. (1921) "The Coccidae. Tables for the identification of the subfamilies and some of the more important genera and species together with discussions of their anatomy and life history". (Scarab Company, Urbana, Illinois).

MAMET, J. R. (1967) New genera and species of Coccoidea from the Mascarene Islands (Homoptera). *Mauritius Inst. Bull.* **6**, 89-102.

RAO, V. P. & FERRIS, G. F. (1952) The genus *Andaspis* MacGillivray (Insecta: Homoptera: Coccoidea). *Microentomology* **17**, 17-32.

SANDERS, J. G. (1906) Catalogue of recently described Coccidae. *Tech. Ser. Bur. Ent. U.S.* **12**, 1-8.

TAKAGI, S. (1970) Diaspididae of Taiwan based on material collected in connection with the Japan-U.S. co-operative science programme, 1965 (Homoptera: Coccoidea) Part II. *Insecta matsum.* **33**, 1-146.

_____ (1992) *Mitulaspis* and *Schizenaspis*: their distributions and taxonomic positions (Homoptera: Coccoidea: Diaspididae). *Ibid.* **47**, 53-90.

_____ & KAWAI, S. (1966) Some Diaspididae of Japan (Homoptera: Coccoidea). *Ibid.* **28**, 93-119.

WILLIAMS, D. J. (1963) Synoptic revisions of I. *Lindingaspis* and II. *Andaspis* with two new allied genera (Hemiptera: Coccoidea.) *Bull. Br. Mus. nat. Hist. Ent.* **15**, 1-31.

_____ (1980) *Andaspis dasi* Williams identical with *A. numerata* Brimblecombe (Hemiptera: Diaspididae), a species found on tea and associated with the fungus *Septobasidium*. *Bull. ent. Res.* **70**, 259-260.

_____ & WATSON, G. W. (1988) "The scale insects of the tropical South Pacific Region Part 1 The armoured scales". (C.A.B. International, Wallingford.).